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Filed : January 16, 2004

REMARKS

The Examiner rejected Claims 1-10 and 14-19. Claims 1-10 and 14-19 are pending. Applicants confirm the withdrawal of Claims 11-13, confirm the previous discussion to further withdraw claims 20-44, and traverse the withdrawal of Claims 20-44. Applicants respectfully remind the Examiner that, "[i]f the search and examination of an entire application can be made without serious burden, the examiner must examine it on the merits, even though it includes claims to independent or distinct inventions." (M.P.E.P. §803).

In the present case, all of the claims now recite the RF power frequency range of 300-500 kHz. Elected Claim 1 has been amended to recite this limitation, originally recited in dependent Claim 15. Additionally, Claim 1 has been amended to recite that a wall of the remote deposition chamber is made of aluminum and that the wall is exposed to the plasma discharge. Finally, Claim 1 has been amended to more explicitly recite a source of a cleaning gas as an element, rather than the cleaning gas as an intended use. Claim 15 has been amended to describe a more particular subset of frequencies.

Support for these amendments can be found throughout the specification and original claims, for example, Claims 1, 15, and 22, paragraphs 0019, 0041, 0070, 0081, 0111, 0024, 0036, 0049, 0081, 0082, 0094, 0150-0154, and 0162 (all paragraph numbering refer to the numbering in the published application). Applicants note that paragraph 0024 of the specification explicitly states that the use of these particular RF frequencies allows the remote chamber to be made of an anodized aluminum alloy and that sapphire or quartz are thereby made unnecessary in the chamber. Moreover, these frequencies reduce the risk of damage during processing, especially to the electrodes, as ion bombardment at the time of cleaning and deterioration of electrode surfaces can successfully be prevented.

New Claim 45 is hereby added. Support for Claim 45 can be found throughout the specification and claims as originally filed, for example, Claims 1 and 22. New Claim 45 depends from novel and nonobvious Claim 1 and recites additional features of particular utility.

Applicants respectfully traverse the rejections, and request allowance in view of the foregoing amendments and remarks discussed below.

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Drawings:

Applicants note that the Examiner has stated that drawings are required because the current drawings “fail to show the detail of the remote plasma chamber as described in the specification.” Applicants note that, as regards the completeness of the application for 35 U.S.C. §112 purposes, as the material is described in the text of the specification, it need not be described in any drawing because it is not “necessary for the understanding of the subject matter sought to be patented” (37 CFR §1.81(a)). Moreover, the Applicants would direct the Examiner’s attention to paragraphs 0036, 0049, 0055, 0075, 0081, and 0082 of the application for additional descriptions of the remote plasma chamber. Applicants agree with the Examiner that the claimed invention is adequately described in the specification and claims.

During a phone conversation with the Examiner on March 24, 2005, the Examiner confirmed that the information was described in the specification and that the request for a drawing was to address more of an informality, rather than an issue regarding the completeness of the application as filed regarding possible §112 issues. The Examiner requested either a drawing or a reference that demonstrates the relationship between the remote chamber and the electrodes.

Applicants note that the specification itself provides a detailed diagram of an *in situ* plasma source that the skilled artisan will appreciate, in view of the application as a whole, could also be employed as a remote source. In particular, Figures 1-3, and paragraphs 0077 and 0078 shows an *in situ* plasma mechanism. Applicants note that the electrodes are capable of delivering power at 13.5 MHz and, in certain embodiments, at 430 kHz, as described in paragraph 0090.

Per the Examiner’s request, Applicants submit herewith an Information Disclosure Statement identifying a Remote Plasma System having aluminum alloy walls and capable of operation in the recited frequency range. This is not intended to be limiting and is only intended to demonstrate one possible embodiment of what one of skill in the art would understand regarding remote plasma systems. It is noted that while the document itself is dated as of 2003, the document states that an ASTRON gas generator was introduced in 1997. As identified in the present application, an arrangement as depicted by the reference advantageously reduces “damage to the electrodes by ion bombardment at the time of cleaning...” (paragraph 0019 of the specification as filed).

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Rejections under 35 U.S.C. §112

The Examiner has rejected Claims 1-10 and 14-19 under 35 U.S.C. §112 as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicants regard as the invention. The Applicants thank the Examiner for his comments regarding the earlier claims and the Applicants have presently amended Claim 1 to instead recite that the “plasma discharge chamber comprises 1) a wall that is made of an aluminum alloy, wherein the wall is exposed to plasma discharge...” Applicants believe that this is sufficient to clarify precisely what is made of aluminum. As such, Applicants request that the rejection under 35 U.S.C. §112 be withdrawn and the claims allowed.

Obviousness Rejections

Claims 1, 2, 14, 16-19 under 35 U.S.C. §103(a)

Claims 1, 2, 14, and 16-19 stand rejected under 35 U.S.C. §103(a) as obvious over Noble (U.S. Pat. No. 6,450,116) in view of Collison (U.S. Pat. No. 6,203,657) and Maydan (U.S. Pat. 6,109,206). Applicants respectfully traverse these rejections.

The Examiner has asserted that Noble teaches a rapid thermal processing apparatus for performing a deposition process, a remote plasma discharge chamber, an inlet member, and that the piping may be made of aluminum. The Examiner further asserts that Collison teaches a plasma processing system with a remote plasma chamber and a protective liner, wherein the chamber wall is grounded and made of conductive material, and wherein a fluorine containing species is generated within the remote chamber. The Examiner further asserts that Maydan teaches a plasma processing apparatus made of aluminum alloy and a remote plasma source comprising an applicator tube of sapphire and a chamber of aluminum. The Examiner asserts that one of skill in the art would have implemented the remote plasma source taught by Collison in the apparatus of Noble as an art recognized equivalent of a remote plasma source. Further, that it would have been obvious to use aluminum alloy as taught by Maydan as a suitable material for making a plasma chamber of Collison.

Applicants disagree with this characterization of the art. As noted in the previous response, Noble is actually discussing a rapid thermal processing (RTP) chamber that is different

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from a CVD chamber, as an RTP chamber is configured for adjusting layers that are already present, rather than depositing layers.

Additionally, Applicants note that a sufficient motivation has not been supplied for combining Noble, Collison and Maydan. While the Examiner has suggested that one of skill in the art would treat the remote plasma source of Collison as an equivalent of Noble, the Examiner is reminded that “[i]n order to rely on equivalence as a rationale supporting an obviousness rejection, the equivalency must be recognized in the prior art, and cannot be based on applicant's disclosure or the mere fact that the components at issue are functional or mechanical equivalents. *In re Ruff*, 256 F.2d 590, 118 USPQ 340 (CCPA 1958).” (M.P.E.P. §2144.06) Nothing in the record suggests that these are equivalent.

Additionally, regarding the motivation for the combination of Maydan with the other references, the Examiner is respectfully reminded that “[t]he mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).” (M.P.E.P. §2143.01). Nothing in the Office Action suggests why it would be desirable to combine Maydan and Collison in the manner described; rather, the Office Action merely states that such a combination would be obvious. As such, no *prima facie* case of obviousness has been established. Applicants, in contrast, have particularly taught the advantages of the recited combination of features for producing a highly effective (high etch rate) cleaning gas while at the same time minimizing equipment damage. Both advantages lead to improved throughput. Nothing in the art suggests that Collison or Maydan should be modified by the teachings of Noble.

However, in the interest of expediting the prosecution of the application, Applicants have amended Claim 1. Claim 1 now further recites that plasma discharge chamber comprises “1) a wall that is made of an aluminum alloy, wherein the wall is exposed to plasma discharge, and 2) a radio-frequency (RF) energy source connected to plasma discharge chamber electrodes, wherein the RF energy source operates at a frequency between about 300kHz and about 500kHz; a source of a cleaning gas, wherein the source of the cleaning gas is connected to the plasma discharge chamber....” Applicants note that an RF chamber (300-500 kHz) with a wall of aluminum alloy that is exposed to the plasma discharge has not been disclosed in the cited prior

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art. Collison employs a quartz liner, Noble employs a quartz or sapphire tube, and Maydan employs an applicator tube of sapphire (508). Moreover, the other relevant references of record do not teach the claimed features. As not all of the elements have been taught by the recited combination, a *prima facie* case of obviousness has not been established.

Additionally, Applicants would note that a source of a cleaning gas is now explicitly recited as an apparatus limitation and that the Examiner must now give proper weight to this limitation. Dependent Claims 2, 14, and 16-19 recite additional elements making the claims patentably distinct in additional ways. Even without these additional elements, as Claims 2, 14, and 16-19 depend from Claim 1, they too are novel and nonobvious.

Claims 3, 4, and 15 under 35 U.S.C. §103(a)

Claims 3, 4, and 15 stand rejected under 35 U.S.C. §103(a) as obvious over Noble (U.S. Pat. No. 6,450,116) in view of Collison (U.S. Pat. No. 6,203,657) Maydan (U.S. Pat. 6,109,206) and Iyer (U.S. Pat. No. 6,498,109). Applicants respectfully traverse these rejections.

The Examiner asserts that Iyer teaches a plasma processing apparatus with a remote plasma discharge chamber coupled to an energy source where the plasma source can be a pair of oppositely placed electrodes, inductive coils, or microwave energy in order to create reactive species. Further, the Examiner notes that Iyer discloses a power range and a frequency range of 10 kHz to 200 MHz. As an initial point, Applicants remind the Examiner that Iyer discloses a plasma etching system, not a CVD chamber, in contrast to Claim 1.

As discussed above, the combination of Noble, Maydan, and Collison does not teach presently amended Claim 1. The teaching of Iyer does not supply the material missing to establish a *prima facie* case of obviousness.

First, as discussed above, the motivation to combine Maydan, Noble and Collison is inadequate to support the proposed combination as no evidence has been provided to suggest an art recognized equivalent and as no actual motivation has been supplied as to why Maydan would be included. Iyer, and the discussion in the Office Action, does nothing to make up for the lack of a motivation to combine.

Additionally, amended Claim 1 now clearly requires a remote plasma chamber with an aluminum alloy wall and an RF power source providing power to remote plasma chamber electrodes at 300-500 kHz. Iyer, similar to Noble, Maydan, and Collison, teaches that the

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“plasma chamber 12” be made of quartz. Thus, there is no teaching that a wall exposed to the plasma discharge be made of an aluminum alloy, and as such, not every element has been taught.

Additionally, while a very broad range of possible frequencies is suggested in Iyer (10 kHz to 200 MHz) and the presently recited range falls within this range, there is no teaching in Iyer or the other references to select the presently claimed range of 300-500 kHz within the over four orders of magnitude of wavelengths provided in Iyer. Applicants acknowledge that a prior art reference that discloses a range encompassing a somewhat narrower claimed range may be sufficient to establish a *prima facie* case of obviousness. However, if the reference's disclosed range is so broad as to encompass a very large number of possible distinct compositions, this might present a situation analogous to the obviousness of a species when the prior art broadly discloses a genus. (See *In re Baird*, 16 F.3d 380, 29 USPQ2d 1550 (Fed. Cir. 1994); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992), see M.P.E.P. §2144.05 and §2144.08). Of this very large possible range of frequencies, the Applicants have only claimed a relatively small subset as desirable for their particular device.

Additionally, Applicants note that all frequencies within the range provided by Iyer are not the same or necessarily “equivalent” for the presently claimed device. For a more detailed discussion, Applicants direct the Examiner’s attention to paragraph 0111 of the present specification, which compares and contrasts the usefulness of the various wavelengths. In particular, this section notes that microwave frequencies have particular problems and that a MHz range power source requires additional machinery. Iyer does not make these distinctions, and rather broadly encompasses ranges suitable for capacitive coupling, inductive coupling, standard microwave remote plasma chambers, etc. Thus, the range provided in Iyer does not make the presently disclosed range obvious. As such, Iyer and the other references are insufficient to teach all of the claimed elements. Additionally, these dependent claims are dependent from a novel and nonobvious claim and are therefore novel and nonobvious themselves. In addition to depending from Claim 1, Claims 3, 4, and 15 add additional patentable distinctions and are therefore novel and nonobvious in light of the above combination.

Claims 5-10 under 35 U.S.C. §103(a)

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Claims 5-10 stand rejected under 35 U.S.C. §103(a) as obvious over Noble (U.S. Pat. No. 6,450,116) in view of Collison (U.S. Pat. No. 6,203,657) and Maydan (U.S. Pat. 6,109,206) and Fujimura (U.S. Patent No. 4,718,976). Applicants respectfully traverse the rejections.

Fujimura is being cited for a teaching of a valve. While Applicants do not agree with the Examiner's characterization of the valve in Fujimura and the presently claimed "through-flow" type valve (as described in 0024, 0026, Figure 4a and 4b), Applicants note that Claims 5-10 depend from Claim 1, which is novel and nonobvious for the reasons noted above. Claims 5-10 add additional elements that further demonstrate the novelty and nonobviousness of the claimed inventions.

Applicants note that Fujimura does not provide the missing motivation(s) or elements (e.g., 300-500 kHz or a wall made from aluminum that is exposed to plasma discharge) noted above in the proposed combinations of Noble, Collison, and Maydan. As Fujimura adds no additional teachings regarding Claim 1, and Claim 1 is novel and nonobvious, Applicants respectfully submit that Claims 5-10 are also novel and nonobvious.

Claims 1, 2, 14, 16-19 under 35 U.S.C. §103(a)

Claims 1, 2, 14, 16-19 stand rejected under 35 U.S.C. §103(a) as obvious over Noble (U.S. Pat. No. 6,450,116) in view of Steinhardt (U.S. Pat. No. 6,706,141) and Maydan (U.S. Pat. 6,109,206). The previous references are cited for the information discussed above. Steinhardt is cited as teaching a plasma processing system with a remote plasma chamber having a coaxial conductor comprising an outer and inner conductor made from a metal such as aluminum. Applicants respectfully traverse these rejections.

The Applicants note that Steinhardt is directed to microwave energy sources and not the energy source that is presently claimed. As such, nothing in this proposed combination teaches the recited energy source (300-500 kHz) and therefore not every element has been taught. As such, a *prima facie* case of obviousness has not been established.

Additionally, a source of a cleaning gas, as recited in the claimed remote plasma chamber, is not provided by the above references. Thus, not every one of the claimed elements is taught by the combination of the references.

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Additionally, the only motive supplied in the Office Action for why one of skill in the art would have combined Steinhardt and Noble is that the remote plasma sources were art recognized equivalents. Applicants note that nowhere in the Office Action has it been established that these different plasma sources are art recognized equivalents. Applicants remind the Examiner that the equivalency must be recognized in the prior art, and cannot be based on applicant's disclosure or the mere fact that the components at issue are functional or mechanical equivalents. (*See, In re Ruff*, 256 F.2d 590, 118 USPQ 340 (CCPA 1958)).

Moreover, Applicants submit that Steinhardt is not prior art. Steinhardt was filed July 21, 2000, and is subject to §102(e) before the AIPA amendment. The present application has a priority date of January 18, 2000. A review of the USPTO PAIR database reveals that the 371(c) date for Steinhardt is July 21, 2000. As this date is after the current application's priority date, Steinhardt cannot be prior art for the present claims.

Applicants note that the WIPO publication associated with this patent is not prior art under the previous version of §102(e) and that the Steinhardt publication is not relevant under §102(a) as its publication was after the current application's priority date.

As it appears that this Examiner was involved in prosecuting the Steinhardt application, Applicants invite the Examiner to provide any additional information concerning when Steinhardt might have met his burden under §371(c)(1), (2), and (4).

Because Steinhardt is not prior art, none of the relevant references, even combined, teach a chamber with an interior surface made of aluminum. As such, each of the elements is not taught and a *prima facie* case of obviousness has not been established. Applicants request that the rejection be withdrawn and Claims 1, 2, 14, 16-19 allowed.

Claims 3, 4, and 15 under 35 U.S.C. §103(a)

Claims 3, 4, and 15 stand rejected under 35 U.S.C. §103(a) as obvious over Noble (U.S. Pat. No. 6,450,116) in view of Steinhardt (U.S. Pat. No. 6,706,141), Maydan (U.S. Pat. 6,109,206), and Iyer (U.S. Pat. No. 6,498,109).

As discussed above, the combination of Noble, Steinhardt (which is not prior art) and Maydan is inadequate to establish a *prima facie* case of obviousness for Claim 1. Briefly, there is no motivation to combine the references as suggested because there is no evidence that these

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chambers are art recognized equivalents, not all of the elements are taught, and no reference teaches or suggests a chamber with a wall of aluminum alloy that is exposed to plasma discharge for use in a remote plasma chamber in a CVD system. None of the asserted references teach the particular recited frequencies. Furthermore, as discussed in detail above, Iyer does not overcome this issue, as Iyer provides a vague disclosure of a broad range of frequencies and the particular frequencies claimed herein have particular properties for the presently claimed invention. As such, a *prima facie* case of obviousness is still not established as the combination lacks motivation and elements that are recited in the present claims. Additionally, even if a *prima facie* case of obviousness had been established, it would have been rebutted by the particular benefits of this particular set of radio frequencies.

Moreover, Applicants note that Claims 3, 4, and 15 depend from Claim 1, which is novel and nonobvious and therefore Claims 3, 4, and 15 are novel and nonobvious. Applicants request that the rejection be withdrawn and the claims allowed.

Claims 5-10 under 35 U.S.C. §103(a)

Claims 5-10 stand rejected under 35 U.S.C. §103(a) as obvious over Noble (U.S. Pat. No. 6,450,116) in view of Steinhardt (U.S. Pat. No. 6,706,141), Maydan (U.S. Pat. 6,109,206), and Fujimura (U.S. Pat. No. 4,718,976).

As noted above, Fujimura has been cited by the Examiner to teach one type of valve. While Applicants do not agree with the Examiner's characterization of the valve in Fujimura and the presently described valve, Applicants believe that the differences discussed herein regarding Claim 1 are sufficient to distinguish the references over the presently claimed invention. Applicants note that Claims 5-10 depend from Claim 1, which is novel and nonobvious, and therefore Claims 5-10 are novel and nonobvious. Fujimura does nothing regarding the deficiencies discussed above for Noble, Steinhardt (which is not prior art) and Maydan. Applicants request that the rejection be withdrawn and the claims allowed.

Conclusion

In view of the foregoing amendments and arguments, Applicants submit that the application is now in condition for allowance and respectfully request the same. If, however, the

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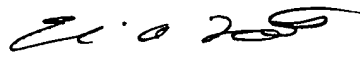
Examiner feels some issue remains that can be addressed by Examiner Amendment, the Examiner is cordially invited to call the undersigned for authorization.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 5/27/05

By: 
Eli A. Loots
Registration No. 54,715
Attorney of Record
Customer No. 20,995
(415) 954-4114

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050505